New Jersey Department of Environmental Protection
Division of Science and Research
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Water Monitoring Project
Water Monitoring Management

James E. Mumman, Administrator

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REAPPRAISAL

SHELLFISH GROWING AREA #SE-4

LUDLAM BAY & TOWNSEND SOUND

1993 - 1997

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SHELLFISH GROWING AREA SE-4

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New Jersey Department of Environmental Protection

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COMMISSIONER

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EXECUTIVE SUMMARY

A sanitary survey was written on this area in February 1996, which covered the time period from 1990 to 1995. That sanitary survey was written to allow for an upgrade of 285 acres of water located on the eastern shore of Ludlam Bay from Seasonally Approved to Approved. This report is a reappraisal of the area. There have been no changes in water quality therefore no change in the classification of area SE-4 is required.

INTRODUCTION

This report is part of a series of studies having a dual purpose. The first and primary purpose is to comply with the guidelines of the National Shellfish Sanitation Program (NSSP) that are established by the Interstate Shellfish Sanitation Conference (ISSC). The second purpose is for input into the State Water Quality Inventory Report, which is prepared pursuant to Section 305(b) of the Federal Clean Water Act (P.L. 95-217).

The information contained in the growing area reports is also used for the New Jersey State Water Quality Inventory Report (305b) which provides an assessment to Congress every two years of current water quality conditions in the State's major rivers, lakes, estuaries, and ocean waters. The reports provide valuable information for the 305(b) report, which describes the waters that are attaining state designated water uses and national clean water goals; the pollution problems identified in surface waters; and the actual or potential sources of pollution. Similarly, the reports utilize relevant information contained in the 305(b) report, since the latter assessments are based on instream monitoring data (temperature, oxygen, pH, total and fecal coliform bacteria, nutrients, solids, ammonia and metals), land-use profiles, drainage basin characteristics and other pollution source information.

From the perspective of the Shellfish Classification Program, the reciprocal use of water quality information from reports represent two sides of the same coin: the growing area report focuses on the estuary itself, while the 305(b) report describes the watershed that drains to that estuary.

The Department participates in a cooperative National Environmental Performance Partnership System (NEPPS) with the USEPA which emphasizes ongoing evaluation of issues associated with environmental regulation, including assessing impacts on waterbodies and measuring improvements in various indicators of environmental health. The shellfish growing area reports are intended to provide a brief assessment of the growing area, with particular emphasis on those factors that affect the quantity and quality of the shellfish resource. As the Department implements a comprehensive watershed management program in conjunction with the NEPPS initiative, the shellfish growing area reports provide valuable information on the overall quality of the saline waters in the most downstream sections of each major watershed. In addition, the reports assess the quality of the biological resource and provide a reliable indicator of potential

areas of concern and/or areas where additional information is needed to accurately assess watershed dynamics.

As a brief history, the NSSP developed from public health principles and program controls formulated at the original conference on shellfish sanitation called by the Surgeon General of the United States Public Health Service in 1925. This conference was called after oysters were implicated in causing over 1500 cases of typhoid fever and 150 deaths in 1924. The tripartite cooperative program (federal, state and shellfish industry) has updated the program procedures and guidelines through workshops held periodically until 1977. Because of concern by many states that the NSSP guidelines were not being enforced uniformly, a delegation of state shellfish officials from 22 states met in 1982 in Annapolis, Maryland, and formed the ISSC. The first annual meeting was held in 1983 and continues to meet annually at various locations throughout the United States.

Parts I and II of the NSSP Manual set forth the principles and requirements for the sanitary control of shellfish produced and shipped in interstate commerce in the United States. They provide basis used by the Federal Food and Drug Administration (FDA) in evaluating state shellfish sanitation programs. There are five major points on which the state is evaluated by the FDA include:

l. The classification of all actual and potential shellfish growing areas as to their suitability for shellfish harvesting.

2. The control of the harvesting of shellfish from areas which are classified as restricted, prohibited or otherwise closed.

3. The regulation and supervision of shellfish resource recovery programs.

4. The ability to restrict the harvest of shellfish from areas in a public health emergency, and

5. Prevent the sale, shipment or possession of shellfish which cannot be identified as being produced in accordance with the NSSP and have the ability to condemn, seize or embargo such shellfish.

The authority to carry out these functions is divided between the Department of Environmental Protection (DEP), the Department of Health and Senior Services and the Department of Law and Public Safety. The Bureau of Marine Water Monitoring (BMWM) under the authority of N.J.S.A. 58:24 classifies the shellfish growing waters and administers the special resource recovery programs. Regulations delineating the growing areas are promulgated at N.J.A.C. 7:12 and are revised annually. Special Permit rules are also found at N.J.A.C. 7:12 and are revised as necessary.

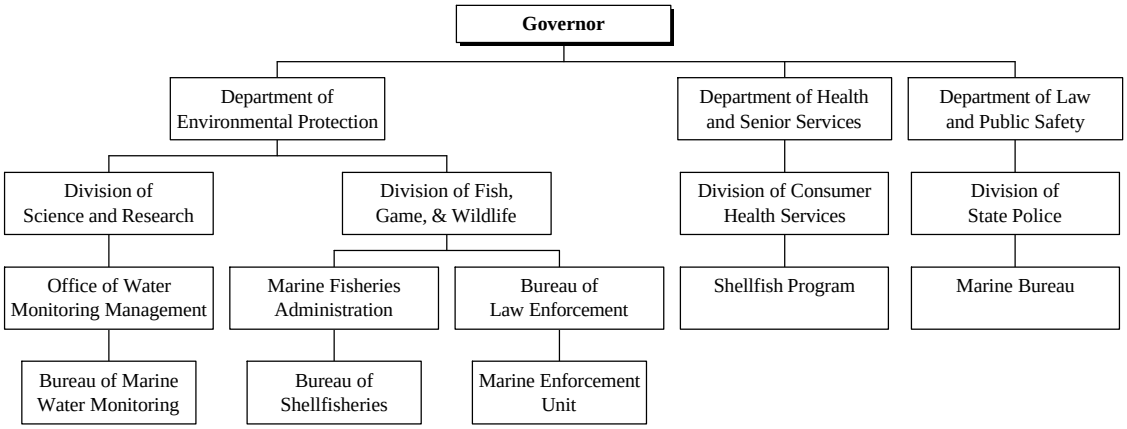
The Bureau of Shellfisheries in the Division of Fish, Game and Wildlife issues harvesting licenses and leases for shellfish grounds under the Authority of N.J.S.A. 50:2 and

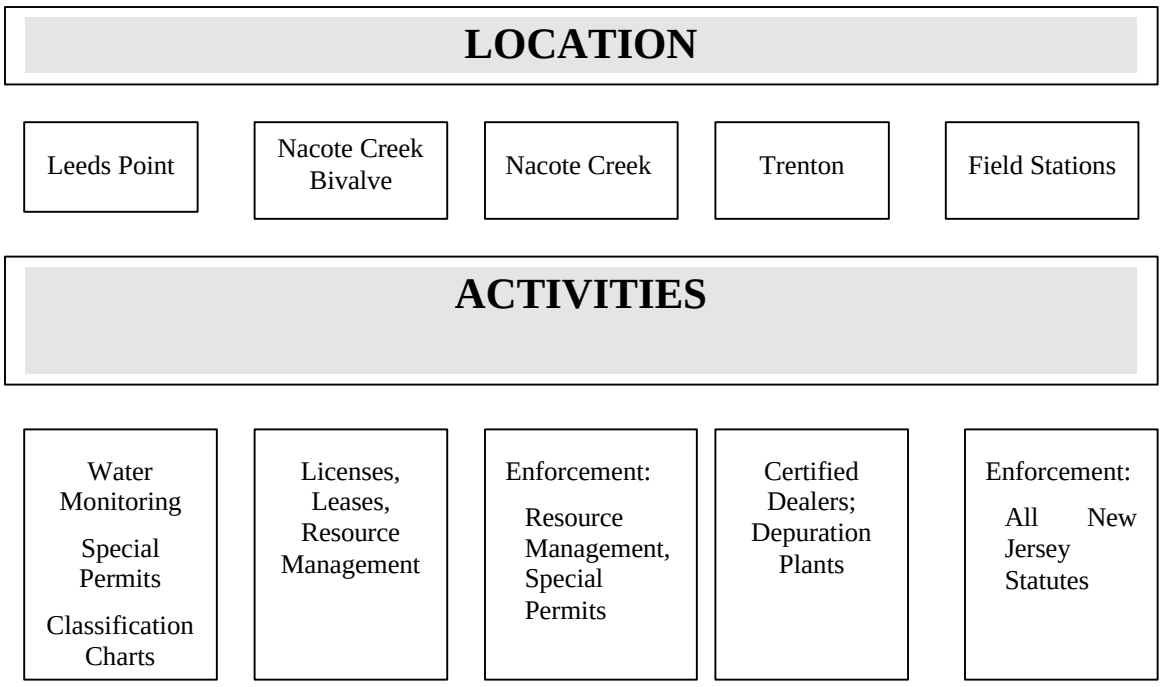
N.J.A.C. 7:25. This bureau in conjunction with the BMWM administers the Hard Clam Relay Program.

The Bureau of Law Enforcement in the DEP (Division of Fish, Game, and Wildlife) and the Division of State Police in the Department of Law and Public Safety enforce the provisions of the statutes and rules mentioned above.

The Department of Health is responsible for the certification of wholesale shellfish establishments and in conjunction with the BMWM, administers the depuration program.

Figure 1: State of New Jersey Shellfish Agencies





Emphasis is placed on the sanitary control of shellfish because of the direct relationship between pollution of shellfish growing areas and the transmission of diseases to humans. Shellfish borne infectious diseases are generally transmitted via a fecal-oral route. The pathway is complex and quite circuitous. The cycle usually begins with fecal contamination of the shellfish growing waters. Sources of such contamination are many and varied. Contamination reaches the waterways via runoff and direct discharges.

Clams, oysters and mussels pump large quantities of water through their bodies during the normal feeding process. During this process the shellfish also concentrate microorganisms, which may include pathogenic microbes, and toxic heavy metals/chemicals. It is imperative that a system is in place to reduce the human health risk of consuming shellfish from areas of contamination.

Accurate classifications of shellfish growing areas are completed through a comprehensive sanitary survey. The principal components of the sanitary survey report include:

An evaluation of all actual and potential sources of pollution,

An evaluation of the hydrography of the area and

An assessment of water quality. Complete intensive sanitary surveys are conducted every 12 years with interim narrative evaluations completed on a three year basis. If major changes to the shoreline or bacterial quality occur, then the intensive report is initiated prior to its 12 year schedule.

The following narrative constitutes this bureau's assessment of the above mentioned components and determines the current classification of the shellfish growing waters.

DESCRIPTION

Area SE-4 is located in Cape May County and includes the area from Sea Isle City and Ludlam Bay to and including Townsend Sound. This area can be found on part of Charts #8 and #9 of the “State of New Jersey-Shellfish Growing Water Classification Charts” (NJDEP, 1997). The principal bodies of water in Area SE-4 are Ludlam Bay, Townsend Inlet, Townsend Sound and Stites Sound. It also includes all of or portions of Ludlam Thorofare, Townsend Channel, Middle Thorofare, Ware Thorofare, Mill Thorofare, North Channel South Channel, Ingram Thorofare and Leonard Thorofare. The municipalities that border this area include Sea Isle City, Dennis Twp and Avalon. Statistics for these municipalities are as follows in Table 1:

Figure 2: SE-4 Classification Chart

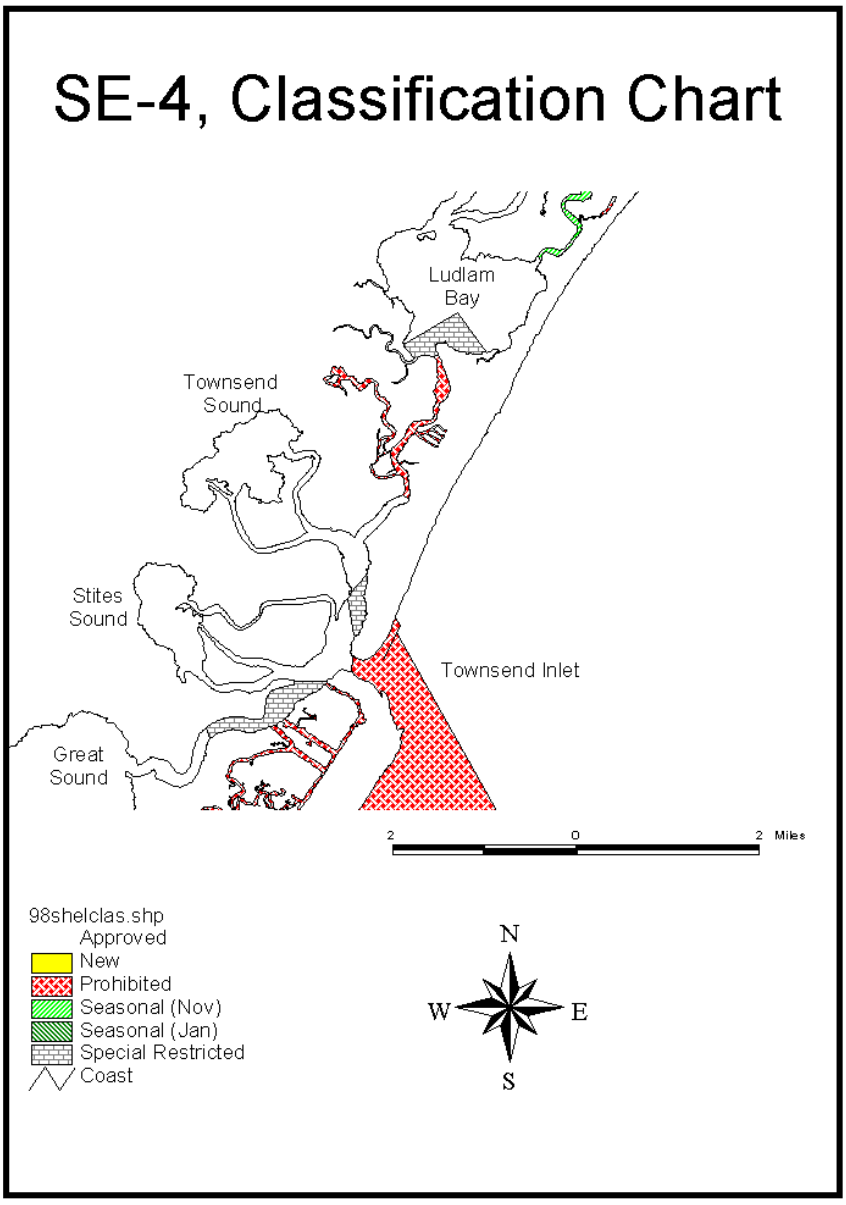


Table 1 : Municipal Statistics for Area SE-4

MUNICIPALITY	POPULATION		POPULATION DENSITY (#/sq. mi.)		AREA
	Year-round	Summer	Year-round	Summer	Square-miles
Sea Isle City	2692	45000	1077	18000	2.5
Dennis Township	5574	5574	88	88	63
Avalon	1809	35000	452	8750	4

The last Sanitary Survey for area SE-4 covered water quality data collected from 1990 through 1995. An Annual report was done in 1996 and 1997. The data collected showed that the water quality was consistent with the present growing water classification for the area.

METHODS

Water sampling was performed in accordance with the Field Procedures Manual (NJDEP, 1992).

Approximately 1400 water samples were collected for total and fecal coliform bacteria between 1992 and 1995 and analyzed by the three tube MPN method according to APHA (1970). Figures 2 and 3 show the Shellfish Growing Water Quality monitoring stations in the area of SE-4. Approximately 73 stations are monitored during each year.

Water quality sampling, shoreline and watershed surveys were conducted in accordance with the NSSP Manual of Operations, Part I, Appendix B (USPHS, 1992).

Data management and analysis was accomplished using database applications developed for the Bureau. Mapping of pollution data was performed with the Geographic Information System (GIS:ARCVIEW).

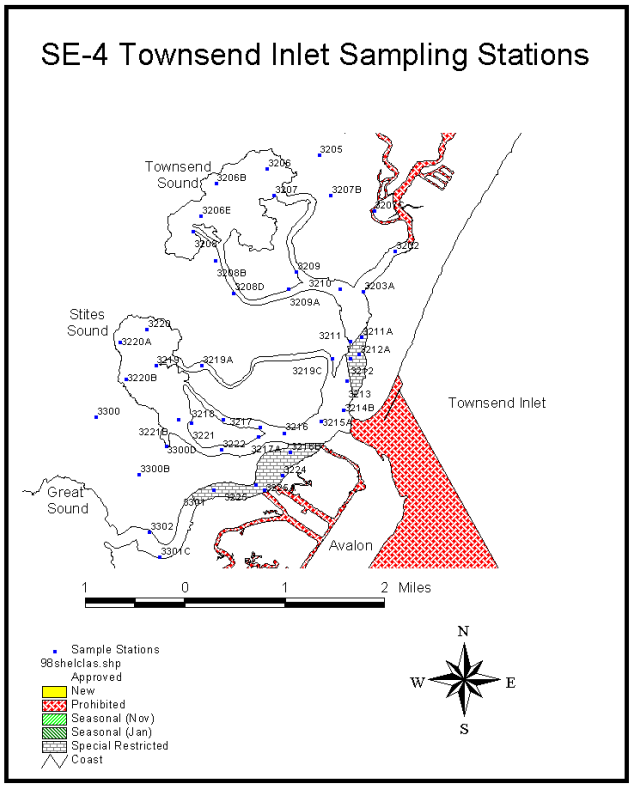
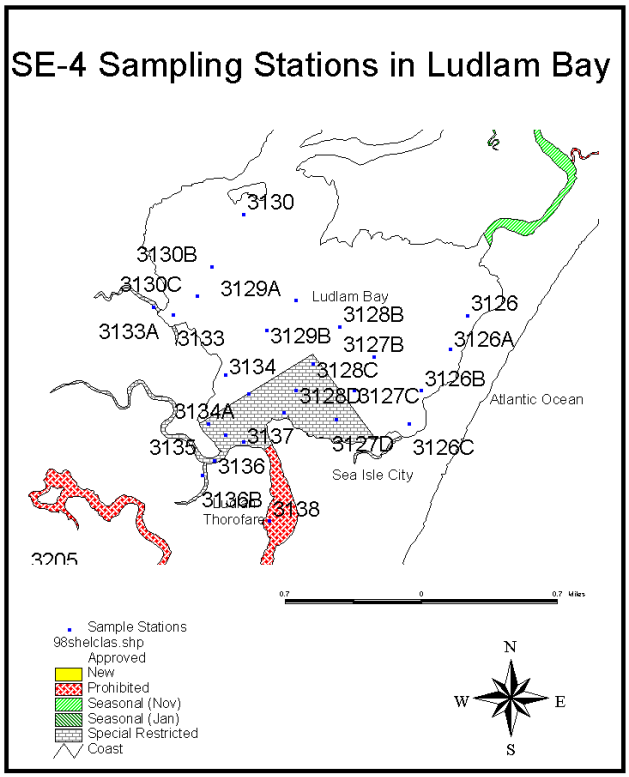


Figure 3 : Sampling Stations in Ludlam Bay

Figure 4: Sampling Stations in Townsend Inlet



BACTERIOLOGICAL INVESTIGATION AND DATA ANALYSIS

The water quality of each growing area must be evaluated before an area can be classified as *Approved, Seasonally Approved, Special Restricted,* or *Seasonal Special Restricted*. Criteria for bacterial acceptability of shellfish growing waters are provided in Part I of National Shellfish Sanitation Program Manual of Operations - 1995 Revision. Each shellfish producing state is directed to adopt either the total coliform criterion, or the fecal coliform criterion. While New Jersey bases its growing water classifications on the total coliform criterion, it does make corresponding fecal coliform determinations for each sampling station. This data is viewed as adjunct information and are not directly used for classification. The State Shellfish Control Authority also has the option of choosing one of the two water monitoring sampling strategies for each growing area.

The Adverse Pollution Condition Strategy requires that a minimum of five samples be collected each year under conditions that have historically resulted in elevated coliforms in the particular growing area. The results must be evaluated by adding the individual station sample results to the preexisting bacteriological sampling results to constitute a data set of at least 15 samples for each station. The adverse pollution conditions usually are related to tide and/or rainfall but could be from a point source of pollution. Variations could also occur during a specific time of the year. Under this strategy, for *Approved* waters, the total coliform median or geometric mean MPN of the water shall not exceed 70 per 100 mL and not more than 10 percent of the samples exceed an MPN of 330 per 100 mL for the 3-tube decimal dilution test. For *Special Restricted* waters, the total coliform median or geometric mean MPN of the water shall not exceed 700 per 100 mL and not more than 10 percent of the samples exceed an MPN of 3300 per 100 mL for the 3-tube decimal dilution test. Areas to be Approved under the Seasonal classification must be sampled and meet the criterion during the time of the year that it is approved for the harvest of shellfish.

The Systematic Random Sampling strategy requires that a random sampling plan be in place before field sampling begins and can only be used in areas that are not affected by point sources of contamination. A minimum of six samples per station are to be collected each year and added to database to obtain a sample size of 30 for statistical analysis. The bacteriological quality of every sampling station in *Approved* areas shall have a total coliform median or geometric mean MPN not exceeding 70 per 100 mL and the estimated 90th percentile shall not exceed an MPN of 330 per 100 mL. For *Special Restricted* areas, the bacteriological quality shall not exceed a total coliform median or geometric mean MPN of 700 per 100 mL and the estimated 90th percentile shall not exceed an MPN of 3,300 per 100 mL.

Area SE-4 is sampled under the Adverse Pollution Condition strategy described above.

MARINE BIOTOXINS

The Department collects samples at regular intervals throughout the summer to determine the occurrence of marine biotoxins. This data is evaluated weekly by the Bureau of Marine Water Monitoring in accordance with the NSSP requirements. An annual report is compiled by the Bureau of Freshwater and Biological Monitoring.

SHORELINE SURVEY

A shoreline survey was conducted in July of 1995, for the purpose of upgrading waters located along the eastern shore of Ludlam Bay. Information pertaining to that shoreline survey can be found in the Sanitary Survey report on Area SE-4 dated February 1996. A shoreline survey was done in the summer of 1997 for the purpose of locating and logging area marinas into the GIS system. (see figures 4 and 5)

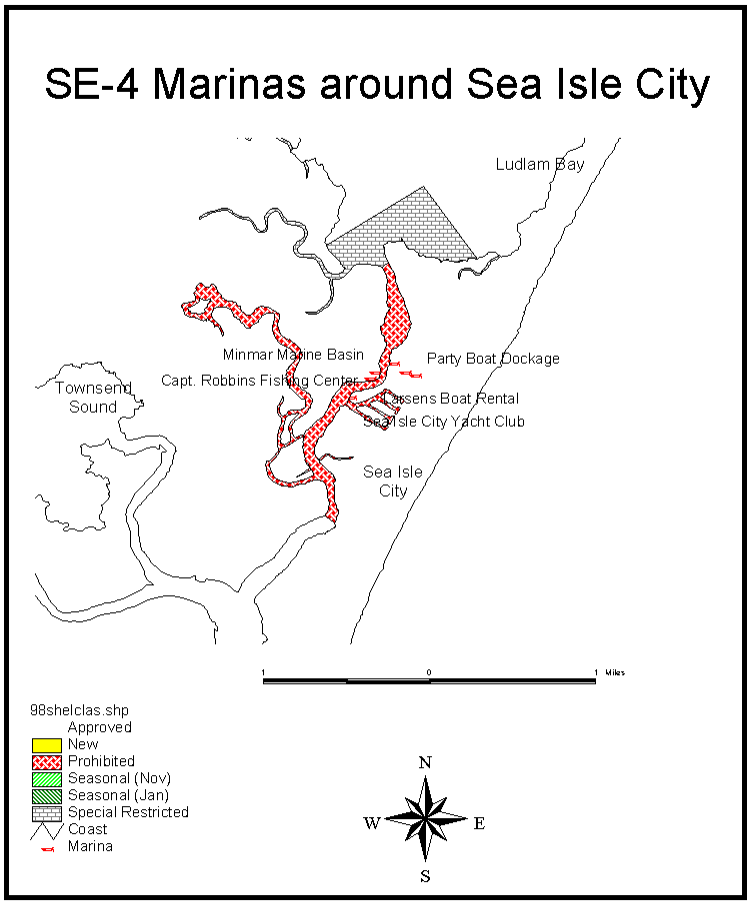


Figure 5: Marinas Near Sea Isle City

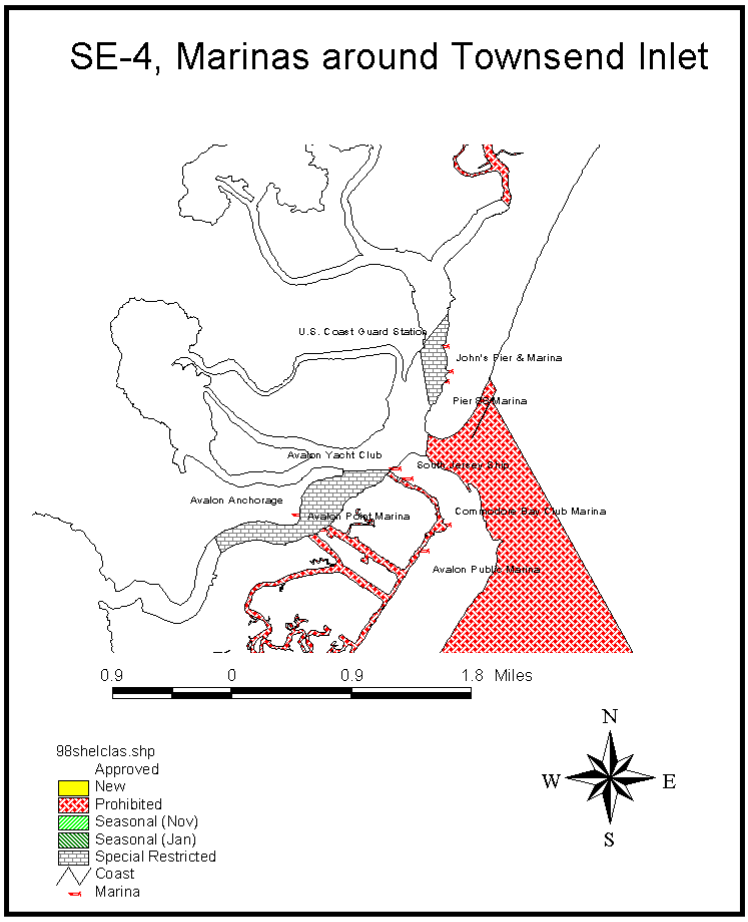


Figure 6: Marinas Near Townsend Inlet

IDENTIFICATION AND EVALUATION OF SOURCES

There are no direct discharges in Area SE-4.

HYDROGRAPHY AND METEOROLOGY

Precipitation inputs to the area for the period 1993 through 1997 are shown in Table 2. There have been no significant changes in hydrography since the last report dated February 1995. The primary weather station for this area is Pomona. The secondary weather station for this area is Atlantic City. The secondary station data is used when data from the primary station are incomplete.

Table 2: Climatological Data

Rainfall Recorded at NOAA's Pomona Station at 1200 hrs; Wind and Temperature aboard sampling vessel at time of sample collection

Sampling Date	Precipitation in Inches			
	Day of Sampling	1 day prior	2 days prior	3 days prior
06/07/93	0.000	0.000	0.080	0.080
06/09/93	0.000	0.130	0.130	0.130
06/11/93	0.000	0.000	0.000	0.000
06/18/93	0.000	0.000	0.000	0.000
07/07/93	0.000	0.000	0.000	0.000
07/09/93	0.000	0.000	0.000	0.000
07/22/93	0.000	0.000	0.050	1.060
08/02/93	0.000	0.050	0.050	0.050
08/24/93	0.000	0.000	0.000	0.000
09/13/93	0.000	0.000	0.000	0.000
03/24/94	0.000	0.000	0.070	1.030
03/30/94	**0.000**	**0.690**	**2.400**	**2.960**
04/29/94	0.000	0.000	0.020	0.020
05/24/94	0.000	0.120	0.1200	0.120
06/14/94	0.000	0.000	0.000	0.000
06/15/94	0.230	0.230	0.230	0.230
07/12/94	0.000	0.000	0.000	0.000

Sampling Date	Precipitation in Inches			
	Day of Sampling	1 day prior	2 days prior	3 days prior
07/13/94	0.000	0.000	0.000	0.000
09/21/94	0.000	0.000	0.000	0.000
09/23/94	**0.050**	**2.460**	**2.4600**	**2.460**
10/26/94	0.000	0.000	0.000	0.690
10/27/94	0.000	0.000	0.000	0.000
03/07/95	0.000	0.000	0.000	0.000
05/05/95	0.040	0.040	0.040	0.500
05/08/95	0.000	0.000	0.000	0.040
07/14/95	0.000	0.000	0.000	0.440
07/18/95	**0.070**	**0.440**	**0.620**	**0.620**
07/31/95	0.000	0.000	0.000	0.010
08/14/95	0.000	0.000	0.020	0.020
09/11/95	0.000	0.000	0.000	0.000
10/24/95	**0.000**	**0.000**	**0.000**	**1.110**
05/02/96	-1.000	-1.000	-1.000	-1.000
05/17/96	-1.000	-1.000	-1.000	-1.000
06/25/96	0.050	0.050	0.050	0.050
07/24/96	0.000	0.010	0.020	0.020
07/29/96	0.000	0.000	0.040	0.280
09/10/96	0.000	0.010	0.010	0.010
09/12/96	**0.670**	**0.710**	**0.710**	**0.720**

Sampling Date	Precipitation in Inches			
	Day of Sampling	1 day prior	2 days prior	3 days prior
09/19/96	**0.080**	**0.200**	**3.470**	**3.470**
10/01/96	0.010	0.090	0.600	0.600
10/09/96	**1.970**	**2.600**	**2.600**	**2.600**
03/21/97	0.000	0.120	0.200	0.200
03/25/97	0.000	0.000	0.000	0.000
06/23/97	0.430	0.430	0.430	0.430
06/25/97	0.000	0.000	0.430	0.430

WATER QUALITY STUDIES

Raw data listings and statistical summaries according to the National Shellfish Sanitation Program (NSSP) criteria are given in the appendix. Figures 2 and 3 (above) show the location of the sampling stations by assignment runs, used to generate the information used in the analysis for this report

INTERPETATION AND DISCUSSION OF DATA

A significant tidal component to water quality was found to occur at only two of the 73 stations sampled in Area SE-4 (see Table 3 and Figure 6). The geometric mean total coliform levels were higher during the flood tide. The stations were located in the area of Stites Sound and Ludlam Thorofare. Since these stations represent < 3% of the total stations sampled, it does not justify the need for this area to be listed as a tidal priority area for sampling purposes.

Table 3: Stations with a Significant Tidal Effect

Station	Geometric Mean Total Coliform MPN		Prob >[T]
	Ebb	Flood	
3211A	2.9	40.7	0.0254
3220B	3.2	7.9	0.0379

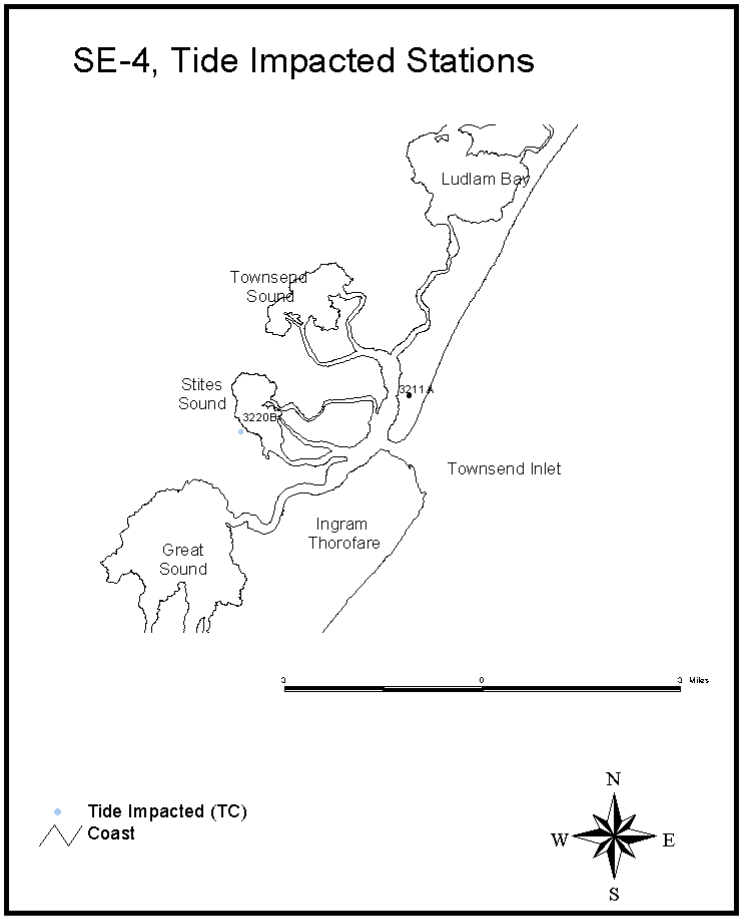


Figure 7 : Stations with Significant Tidal Impact

A significant correlation between total coliform MPN and rainfall was found to occur at 49 stations out of 73, (see Table 4 and Figure 7). The stations affected are located throughout the SE-4 area including areas along the coast of Sea Isle City, Townsend Inlet, North Channel, Townsend Channel, Townsend Sound, Stilts Sound and Ingram Thorofare. It is noted, however, just as was reported in the previous Sanitary Survey for this area, there were certain days within this time period that had exceptionally high levels of rainfall. The majority of those stations sampled were only over criteria on those days when the rain was in excess of 1 inch. There were four times in particular where the rainfall was abnormally high: March 1994 (2.960), September 1994 (2.460), September 1996 (3.470) and October 1996 (1.970).

Table 4: Stations with a Significant Rainfall Correlation

Station	Correlation of total coliform with rainfall			Number of Observations
	Day of Sampling	24 hours prior	48 hours prior	
3126	0.7003	0.2381	0.5484	22
3126A	0.6253	0.6222	0.6101	22
3126C	0.6879	0.55400	0.4654	22
3127D	0.4784	0.5668	0.6706	22
3128D	0.0880	0.6861	0.6156	22
3130	0.7041	0.3309	0.2734	22
3130B	0.7896	0.1549	0.0251	22
3133A	0.7517	0.6069	0.4404	22
3134	0.5058	0.2603	0.6452	22
3134A	0.4249	0.5950	0.6113	22
3134C	-0.0778	0.6446	0.6581	22
3135	0.3414	0.6302	0.9015	22
3135A	0.3922	0.5761	0.7938	22

Station	Correlation of total coliform with rainfall			Number of Observations
	Day of Sampling	24 hours prior	48 hours prior	
3136	0.5044	0.7009	0.7355	22
3136B	0.4591	0.6782	0.7238	22
3137	0.3956	0.8191	0.8098	22
3138	0.2776	0.68750	0.5682	22
3203A	0.7048	0.2321	-0.0471	22
3205	0.4675	0.6677	0.5937	22
3206	0.6175	0.0916	0.1685	22
3207	0.2350	0.3380	0.8323	22
3207B	0.2197	0.6596	0.6789	22
3208	0.6899	0.4358	0.2642	22
3208B	0.7778	0.6386	0.2757	22
3209A	0.6863	-0.0494	-0.2843	22
3211	0.5189	0.8231	0.8496	20
3211A	0.5511	0.5690	0.6101	20
3212A	0.3580	0.5963	0.7138	20
3213	0.8474	0.5342	0.5181	20
3215A	0.6490	0.3700	0.4386	20
3216B	0.5837	0.5872	0.6606	19
3219	0.6045	0.0429	0.0297	20
3219A	0.6883	0.2200	0.2094	20
3220	0.6378	0.6896	0.6879	20

Station	Correlation of total coliform with rainfall			Number of Observations
	Day of Sampling	24 hours prior	48 hours prior	
3220A	0.7068	0.5837	0.5821	20
3220B	0.6488	0.3385	0.3319	20
3221	0.7510	0.39380	0.3785	20
3221B	0.8432	0.2105	0.2003	20
3222	0.7599	0.3333	0.3355	20
3224	0.8056	0.8440	0.8423	19
3225A	0.7054	0.7488	0.8346	19
3300	0.9907	0.9906	0.9729	9
3300B	0.9394	0.9400	0.9302	9
3300D	1.0000	1.0000	0.9892	9
3301	0.9951	0.9953	0.9859	9
3301C	0.9974	0.9975	0.9855	9
3302	0.9254	0.9258	0.9376	9
3303A	0.7323	0.7328	0.7089	9
3303B	0.6398	0.6418	0.6053	9

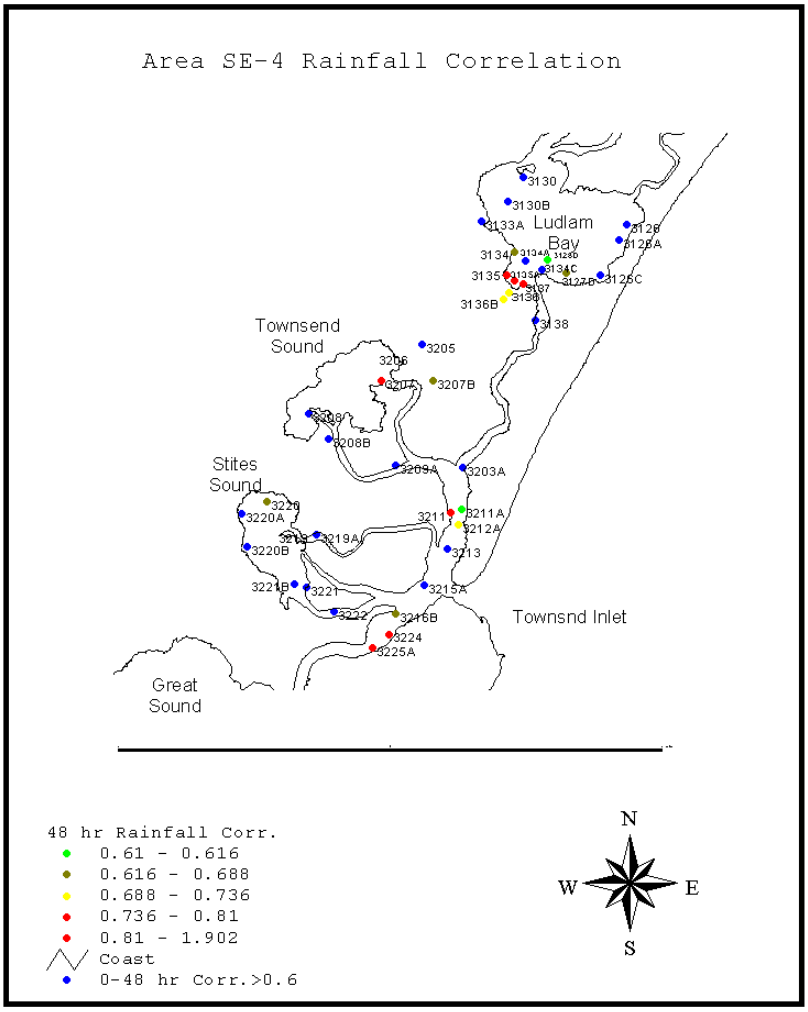


Figure 8: Stations with Significant Rainfall Correlation

CONCLUSIONS

Water quality in area is still very good with 100% of the 73 stations sampled in compliance with the existing water quality classification. This area is an example of an area that is effected by rainfall only in excess of 1 inch. As per the information stated in the Interpretation and Discussion portion of the report this area will not be classified as a rainfall priority area for sampling purposes. However, it should be noted that this area should be evaluated individually whenever there are periods of heavy rainfall, (> 1 inch). There are no changes in classification or sampling protocol required at this time.

RECOMMENDATIONS

No recommendations for changes in classification or sampling protocol are required at this time. However, it is recommended that this area be closely monitored during periods of excessively heavy rainfall.

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ACKNOWLEDGMENTS

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APPENDICES

Appendices noted in this report are **not** available for download.